

## SOIL CARBON

### Purpose

1. This paper clarifies the role of soils in Scotland in relation to carbon capture and greenhouse gasses and outlines the strategic areas that should become the focus for SNH activities. The paper sets out SNH's role in the context of the Governmental targets and initiatives, primarily the National Performance Framework outcomes and the Scottish Soil Framework, and SNH's own Corporate Strategy and Climate Change Action Plan.

### Action

2. **The Board is asked to:**
  - **Note the context for SNH's work on soil carbon.**
  - **Consider and approve the roles identified for SNH (paragraph 13).**
  - **Consider and agree the strategic areas of work that should become the focus for SNH's activities on soil carbon (paragraphs 16-25).**

### Preparation of Paper

3. This paper was prepared by Patricia Bruneau in consultation with Greg Mudge, John Gordon, Clive Mitchell, Duncan Stone, Andrew Coupar, Brendan Turvey and Bill Band. Additional advice was provided by Prof. Colin Campbell (Scientific Advisory Committee). The paper is sponsored by Susan Davies.

### Background

4. The Board has previously considered papers relating to soil and the opportunities for capturing carbon and reducing GHG, as well as the potential risks for loss of carbon on organic-rich soils (e.g. peat and peatland) - SNH Board/MT strategic discussion meeting 11 November 2009 ([B455689](#)) and SNH's contribution to the Scottish Soil Framework - SNH Board meeting 18 August 2009 Info 4 ([B420878](#)).
5. The National Performance Framework recognises the quality of Scotland's environment and natural heritage as a key asset and source of economic prosperity (or wealth creation). Soils underpin the functioning of our ecosystems and deliver supporting, provisioning and regulating ecosystem services. One of the key regulating services it provides relates to its roles as both a potential source and sink of carbon and greenhouse gases. This role in relation to soil carbon and greenhouse gas emissions in climate regulation, means soil play a key role in the protection and enhancement for future generations of our built and natural environment (National Outcome 12) and in contributing to the Scottish Government Sustainability purpose and target to reduce greenhouse gas emissions by 80% by 2050.
6. SNH supports the Scottish Government's Scottish Soil Framework (SSF) which was launched in May 2009. The Framework promotes the sustainable management and protection of soils for the economic, social and environmental stability of Scotland. It recognises that the most significant pressures on Scotland's soils are climate change and loss of carbon from our soil. The SSF sets in place a vision for the protection of soils in Scotland, with 13 Soil Outcomes (SO). Of specific relevance to soil carbon

are SO1 “soil organic matter stock protected and enhanced where appropriate” and SO4 “greenhouse gas emission from soils reduced to optimal levels”.

7. The cool wet climate of Scotland means that loss of carbon through decomposition is slower than in warmer, drier areas of the UK. As a result proportionally more carbon has accumulated in Scottish soils compared to other UK and European regions. If degraded it could become a significant source of greenhouse gases and carbon loss. The sustainable management of the existing soil carbon resource, as well as options for increasing soil carbon storage, are integral to achieving the Government’s targets for reductions in greenhouse gas emissions by 2050 under the Climate Change Act (2009). SNH’s Climate Change Action plan sets out objectives relating to improving understanding of soils, restoration of soils and the role of soils in climate change mitigation and adaptation. It recognises the importance of managing land to retain carbon in vegetation and soils, taking into account the balance to be struck between the benefits of soil carbon sequestration and any direct adverse impacts such management may have on the natural heritage.
8. The forthcoming Land Use Strategy also recognises a range of topics in relation to soils policy, including soil carbon, loss of topsoil fertility and the non-renewable nature of soils. It stress that carbon accounting should be factored into all decision making – both in terms of planning and land use more widely.

### Scotland’s soil carbon resource

9. Soils in Scotland hold over 3000 Mega tonnes of carbon, with around 60% being held in deep peat soils. This resource has accumulated over millennia but is increasingly at risk from change through the dynamics of natural processes and the direct impacts of land-use change and other anthropogenic impacts which can degrade soil and result in loss of carbon much more quickly. This ‘long-time to form / short time to lose’ situation means that protecting existing soil carbon store is arguably the first priority.
10. The Macaulay Land Use Research Institute recently derived an estimate of the soil carbon stock in protected sites in Scotland from data held in the National Soil Inventory database. Such analysis provides an overview of the order of magnitude of carbon stored in designated sites but cannot be used as baseline monitoring assessment. This indicates that all SSSIs in Scotland hold around 30% of the total soil carbon stock (0-100cm depth) in just 13% of the land area of Scotland. The highest soil carbon concentration is associated with ‘Biological’ SSSI (404 C t/ha) compared to ‘Geological’ SSSIs and ‘mixed SSSIs with respectively 379 and 287 C t/ha.

	SSSI	RAMSAR	NNR	SAC	SPA
Total area (km <sup>2</sup> ) <sup>1</sup>	104	32	13	100	105
Total C Mt (0-100 cm depth)	373	120	45	241	256
Equivalent C in t/ha (average 320t/ha in 0-100 cm)	358	367	337	240	244

(<sup>1</sup>) This only includes terrestrial sites and excludes water bodies.

## **SNH's role**

11. Given the wide-ranging scope of soil conservation and management, it is important that SNH's activities are clearly focused where we can make a real difference and in a way which reflects our advisory role, as opposed to a regulatory role, which is undertaken by SEPA, Scottish Government departments (e.g. FCS, HS) and Local Authorities.
12. A specific SNH role is also defined in the Scottish Soils Framework under: 1) conservation and biodiversity actions - "*SNH and the Scottish Government will consider how soils and below ground biodiversity can be given more consideration in the management of sites designated for their nature conservation interest*"; 2) "*Development of Scottish geodiversity framework activities will give appropriate consideration to soils' values and functions*", and 3) climate change - "*SNH will review its involvement in activities and policies relating to the soil, taking into account of the need to protect soil organic carbon, as a means of mitigating climate change*".
13. Whilst no given agency has an overall lead role on soil carbon issues, SNH nevertheless can support activity in this area which closely relate to our own remit by focusing on:
  - raising awareness of, and advising on, the importance of soil carbon and the consequences if it is not managed effectively;
  - guiding the management of the natural heritage in a way which best protects soil carbon, as well as the biodiversity interests;
  - advising on the management of wider land use change (e.g. forestry planting, windfarm development) so that it takes account of the impact on soil carbon;
  - setting an example on our own landholdings to demonstrate good climate change mitigation and adaptation practices.
14. In delivering our role we will need to balance the interests of semi-natural habitats and biodiversity with the requirements of other land use and the need to support the Scottish Government's vision for alternative used of land e.g. the generation of 31% of gross electricity consumed in Scotland to come from renewable sources by 2011 and 50% by 2020.
15. SNH is not the lead on soil carbon activities, but we do need to seek to influence decision making processes at an early stage to ensure that soil, biodiversity and landscape interests are given appropriate consideration in the development of new research and policy implemented by our partners.

## **Strategic priorities for SNH**

16. The relationship between the high level strategic objectives and SNH activity is highlighted in Annex 1. Taking the background context and the roles defined above, it is recommended that SNH focuses its activities in 4 priority areas. :
  - Protected areas
  - Peatland management
  - Woodland management

- Renewable energy and land-use change

### Priority 1 – Protected areas

17. Soils are not a feature type that is designated under national and international nature conservation legislation, although some specific soil functions (e.g. as a repository for historical and palaeoenvironmental markers) are recognised in the SSSI system under Quaternary of Scotland geological features (19 SSSIs in Scotland). There are also several protected soil biodiversity species such as ectomycorrhizal fungi and various soil dwelling invertebrates. Soil function and condition are, however, an integral part of many site management activities, and ‘healthy’ functional soils capable of delivering a full range of ecosystems services are required to support species and habitat condition and diversity. The Nature Conservation Act review of designated site features and operations requiring consent provide an opportunity during the remainder of the programme to assess soil resources on individual sites and identify further management options that align nature conservation objectives with carbon sequestration and reduction of emissions.
18. The key actions for SNH in this area are to:
  - Priority 1-1 raise awareness among SNH and its customers about the carbon stored in protected areas and the contribution that this makes to mitigating climate change;
  - Priority 1-2 support and engage on research activities that inform management decisions about carbon sequestration and the reduction of emissions from soils;
  - Priority 1-3 review our NNR management practices to ensure that they take account of climate change mitigation and adaptation measures and demonstrate how soils can best be managed alongside the biodiversity interests.

### Priority 2 – Peatland management

19. Scotland supports a wide range of peatland habitats of national and international importance. Peatlands contain the highest stock of soil carbon in their peat deposits. Peat contained in wetlands is also a major carbon store. The recognition of the role of peatland as a significant carbon sink has driven extensive national research programmes to establish the extent and condition of the soil carbon stock in Scotland and is providing new evidence (e.g. RERAD WP3 protecting the nation’s soil, SNH CR325 “*Climate change, land management and erosion in the organic and organo-mineral soils in Scotland and Northern Ireland*”) to support effective policy and advice. The Scottish Soil Framework recognises the lead role of SNH in the provision of advice and guidance on soil carbon in peatland.
20. The key actions for SNH in this area are to:
  - Priority 2-1 develop SNH advice on the management of peatland and wetland habitats to take account of carbon storage, alongside the biodiversity importance of the habitats;
  - Priority 2-2 develop SNH advice on the prescriptions required to manage peatland on SSSIs and in the wider countryside through SRDP/RDC incentives;

- Priority 2-3      advise planning authorities who have to consult SNH in cases which involve the working of peat. A number of permissions are due to expire within 5 years and there may be applications for renewal. SNH will need to advise in relation to industrial extraction of peat for 1) domestic and industrial heat – energy production; 2) burning for non-energy purposes (e.g. malting); and 3) horticultural and soil conditioning products.

### **Priority 3 – Woodland management**

21.      A key issue in relation to carbon sequestration is where the new woodland envisaged in the Scottish Forestry Strategy is to be planted. Woodlands have the capacity to sequester atmospheric carbon in their timber and litter, and increase soil carbon levels. However under certain circumstances these benefits can also be reduced or negated, particularly when trees are planted on land which already have high carbon content (peat and peaty soils) where soils may lose carbon through tree induced effects on soil carbon turnover (e.g. drainage).
22.      The current target for FCS policy for new woodland is 10-15,000ha per year – a quadrupling of the current rate of planting. Despite the commitment by Scottish Government to ensure the Forestry Commission can invest £15 million a year in new woodlands to help increase forest cover to 25% as rapidly as possible, good quality and highly productive farmland remains financially out of reach for large-scale afforestation. This again focuses attention on marginal areas (i.e. those with peaty soils or at least moderate to high soil carbon content). SNH's interests here are focused on steering afforestation away from soils which high carbon content. While this is largely compatible with wider biodiversity objectives, there may need to be trade-offs where native woodland regeneration and expansion is proposed on such areas. The potential for significant external investment through carbon trading makes it even more important to contribute to this process. SNH thus needs to ensure that on sites of high conservation value, the carbon sequestration potential in new woodland is balanced against the biodiversity interest of the site and its existing potential as a soil / vegetation carbon sink.
23.      The key actions for SNH in this area are to:
- Priority 3-1      ensure that updates to SNH guidance fully reflects the balance between carbon storage and other objectives that relate to the natural heritage;
  - Priority 3-2      develop SNH advice on potential site restoration and reseedling strategy of woodland and plantations shortly due for felling;
  - Priority 3-3      engage with FCS, through the Scottish Land Use Strategy, on priorities and the need to balance biodiversity/soil carbon/woodland interests with future woodland expansion aspirations;
  - Priority 3-4      collaborate with FCS/FR and others to develop an agreed model of carbon fluxes in relation to afforestation (including native woodland) on peaty soils.

### **Priority 4 – Renewable energy and land use change**

24.      SNH has a clear commitment to advise on land management practices that help to mitigate against climate change. The forthcoming Land Use Strategy identifies that

the management of farmland can play an important role in the delivery of a wide range of public goods from which all of society benefits, including protection of soils and greenhouse gas emission mitigation. SNH also has a role to promote options that reduce the amount of soil and carbon loss as waste during planning developments and to ensure that site restoration options contribute to long-term carbon and biodiversity interests.

25. Key activities for SNH in this respect are to:

- Priority 4-1 work collaboratively with industry and SEPA to develop and promote use of decision-making tools to assess carbon impacts of development, especially to reduce waste of soil and soil carbon as by-products of site development;
- Priority 4-2 work collaboratively with the industry and SEPA to produce guidance on Good Practice, including the minimisation of soil disturbance, during Windfarm Construction;
- Priority 4-3 provide advice on the use of peat and other soils in the restoration of renewable energy development sites;
- Priority 4-4 produce guidance and advice for sustainable use of soils for the protection of habitats, species and landscape, linking with the Scottish Soil Framework, SRDP measures and UK-led activities (SNH Climate Change Action Plan S2);
- Priority 4-5 continue our engagement with Scottish Government to ensure that soil carbon is included in the identification of the principles of sustainable land use in the forthcoming Scottish Land Use strategy and is balanced within a whole ecosystem approach.

### Resource requirements

26. The priorities outlined can be described as low input in terms of staff time and direct resource costs but are potentially high impact if we approach the influencing and awareness raising activities effectively. The priorities can be delivered within SNH's existing resource commitments, albeit that there may need to be some readjustment of the balance of effort depending on the timescales for implementation.

### Conclusions

27. The vision for the sustainable management of soils in Scotland has been set out by the Scottish Government in the Scottish Soils Framework. SNH has a role as a member of the Soil Focus Group advising on policy review and development in areas relevant for sustainable soil use and management.

28. Given this background context, it is important that the emphasis of SNH's support and advisory role is highlighted and that our efforts are targeted in 4 key priority areas – protected areas, peatland management, woodland management, and renewable energy and land use change. **The Board is asked to confirm that SNH's role has been appropriately defined and that the key priorities identified provide the appropriate focus for SNH's engagement on soil carbon.**

**Annex 1- Relationships between national and organisational objectives/ outcomes and priorities activities listed in main paper.**

Objectives relevant to soil carbon	Priority areas 1			Priority areas 2			Priority areas 3			Priority areas 4					
	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	4.3	4.4	4.5
<p><b>National Performance Framework - National outcome 12 and 14</b></p> <ul style="list-style-type: none"> <li>▪ Implement the new Climate Change (Scotland) Act 2009 which commits to reduce Scotland's emissions levels by 80% by 2050.</li> <li>▪ Ensure the Forestry Commission can invest £15 million a year in new woodlands to help increase forest cover to 25% as rapidly as possible.</li> <li>▪ Ensure that 20% of total Scottish energy use is from renewable sources by 2020.</li> <li>▪ Address the challenge of sustainable food in a new National Food Policy</li> <li>▪ Implement the Scottish Biodiversity Strategy, including movement towards a wider ecosystem approach to nature conservation</li> <li>▪ Enter into rural development contracts under the £1 billion plus Scotland Rural Development Programme to help farmers, crofters and others to conserve, enhance and manage the rural environment.</li> <li>▪ Vigorously pursue delivery of the zero waste policy, as set out in the national zero waste plan, to be launched in spring 2010, setting challenging targets for waste prevention, improved recycling and reuse and for reduction in municipal and commercial waste sent to landfill; allocating £150 million to the Zero Waste Fund and developing a range of policy interventions.</li> </ul>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<p><b>Scottish Soil Framework (2009)</b></p> <ul style="list-style-type: none"> <li>▪ SO1 Soil organic matter stock protected and enhanced where appropriate</li> <li>▪ SO2 Soil erosion prevented</li> <li>▪ SO3 Greenhouse gases emission from soils reduced to optimal level</li> <li>▪ SO4 Soil biodiversity, as well as above ground biodiversity, protected</li> <li>▪ SO5 Soil's productive capacity to produce food, timber and other biomass maintain and enhanced</li> </ul>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<p><b>Rural Land Use Strategy (fbc 2010)</b></p> <ul style="list-style-type: none"> <li>▪ Long-term sustainable land use policies</li> </ul>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<p><b>SNH Corporate Strategy (2008-2013)</b></p> <ul style="list-style-type: none"> <li>▪ Caring for Nature</li> <li>▪ Responding to Climate change</li> <li>▪ Delivering Health and Well-being</li> <li>▪ Supporting the Scottish economy</li> <li>▪ Delivering a high quality public service</li> </ul>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<p><b>SNH Climate change Action plan (2009-2014)</b></p> <ul style="list-style-type: none"> <li>▪ Helping to understand and publicise the effects and consequences of climate change for the natural heritage</li> <li>▪ Advising on infrastructure and land management practices which help to mitigate climate change</li> <li>▪ Guiding adaptation so that nature can as far as possible adapt to a changing climate and so that people can make best use of natural processes in preparing for climate change</li> <li>▪ Promoting action by organisations and individuals by setting an example in the management of SNH's own operations, and communicating our climate change messages clearly and effectively</li> </ul>	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

